GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

Subject Area D

Cost- and energy-efficient use of computing resources

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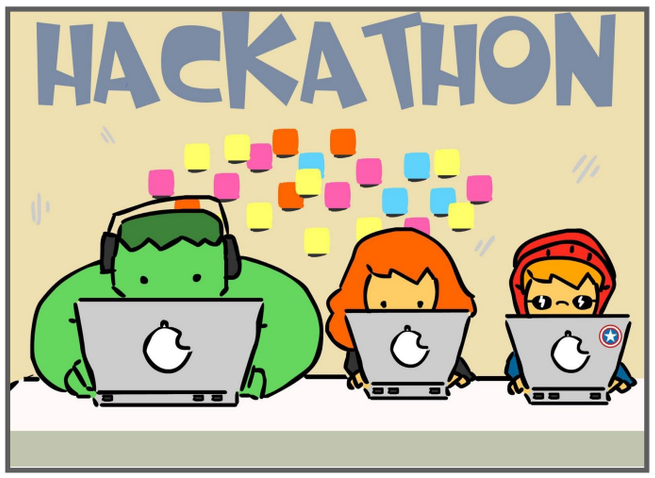
Kick-Off Meeting, Feb 2019

AP D2: KIT

https://indico.physics.lbl.gov/indico/event/712/

ACTS Workshop Overview

- 22 Participants from various experiments
  - **2 ACTS experts:** Dr. Moritz Kiehn und Paul Gessinger
  - Members from **ATLAS**, **Belle II**, and **Mu2e**
- Diverse 5 day program
  - Mix of **tutorials** from Moritz and Paul;
  - Talks from Belle II (Dr. Nils Braun), ATLAS (Dr. Nick Styles), Mu2e (Dr. Dave Brown) tracking challenges
- A lot of **Hackathon** time to kick-start projects



Example Projects

Implement Belle II geometry (VXD)

Project Goal: Belle II -> ACTS and handle non-cylindrical silicon sensors easily

Project Motivation: Necessary to benchmark ACTS against existing tracking code in Belle II. Potentially generalize to other experiments.

Project Roadmap:

1. understand how I built PXD Geometry with "helpers"
2. understand how to built SVD Geometry
3. write testing/validation for it
4. add material effects

Implement a CKF

Project Goal: Wrap a CKF around Kalman

Electron Fitter with Bremsstrahlung

Project Goal: Study the status of the Gaussian sum filter implementation, how this connects to incorporating Bremsstrahlung information

ACTS with GPUs

Project Goal: To define a target use case for GPUs within ACTS and provide a roadmap for doing so

Project Motivation: GPUs are a powerful tool for fast processing. Many difficulties to utilization, but

Project Roadmap:

1. Decide on target use case (track-seeding, clustering?) and target language (OpenCL, CUDA, VulKan)
2. Define metrics to assess performance
3. Write interface to skeleton

Project Participants: Lauren*, ??

*NB when originally proposed there was some hope th

ACTS for Testbeam Reconstruction

Project Goal: Use ACTS to reconstruct tracks from hits registered in a 6-plane pixelated telescope.

Project Motivation: Great beginner application, expands user-base, ...

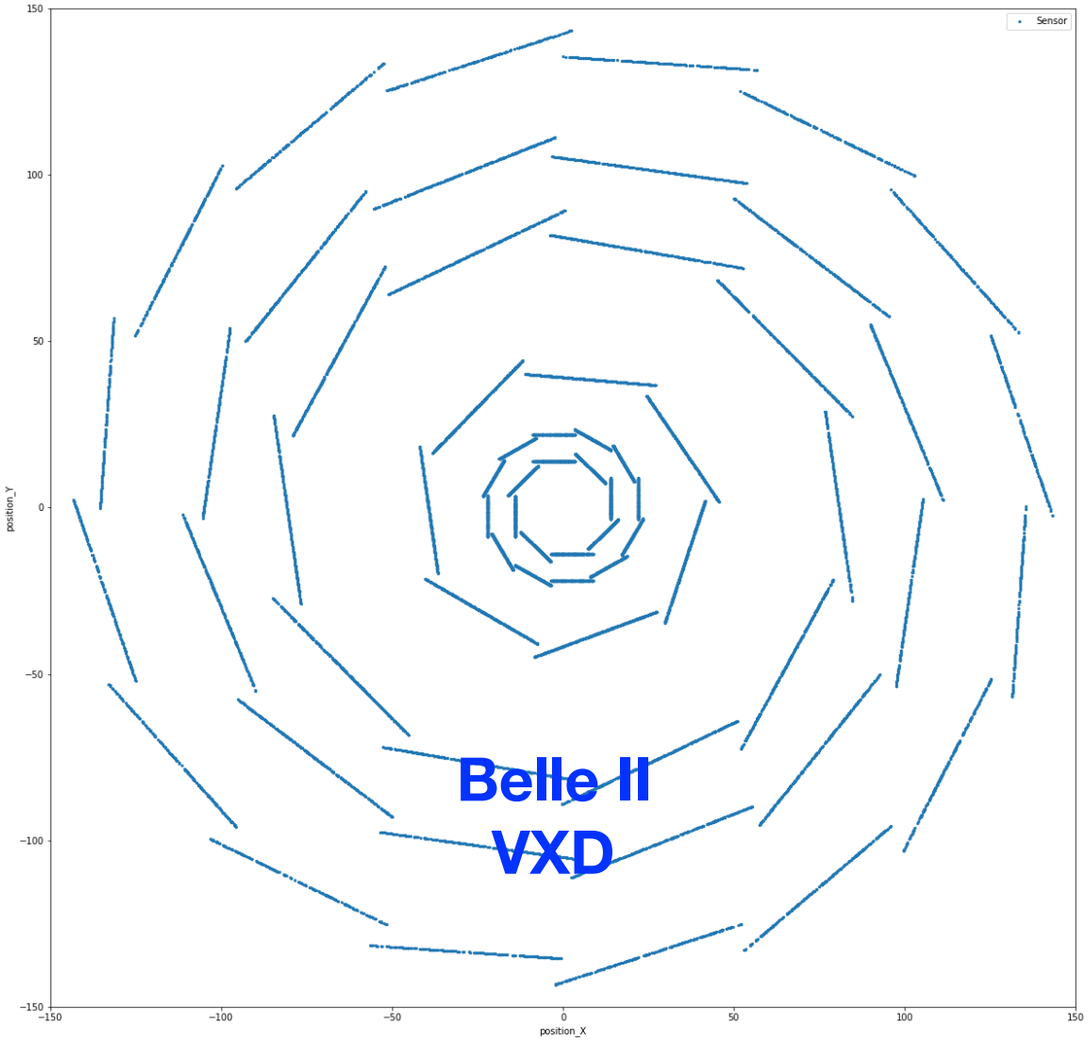
Project Roadmap: (1) Implement simple 6 plane geoemtry (2) Parse data testbeam data from telescope (3) Align planes (4) Fit tracks (Bonus) Account for multiple scattering

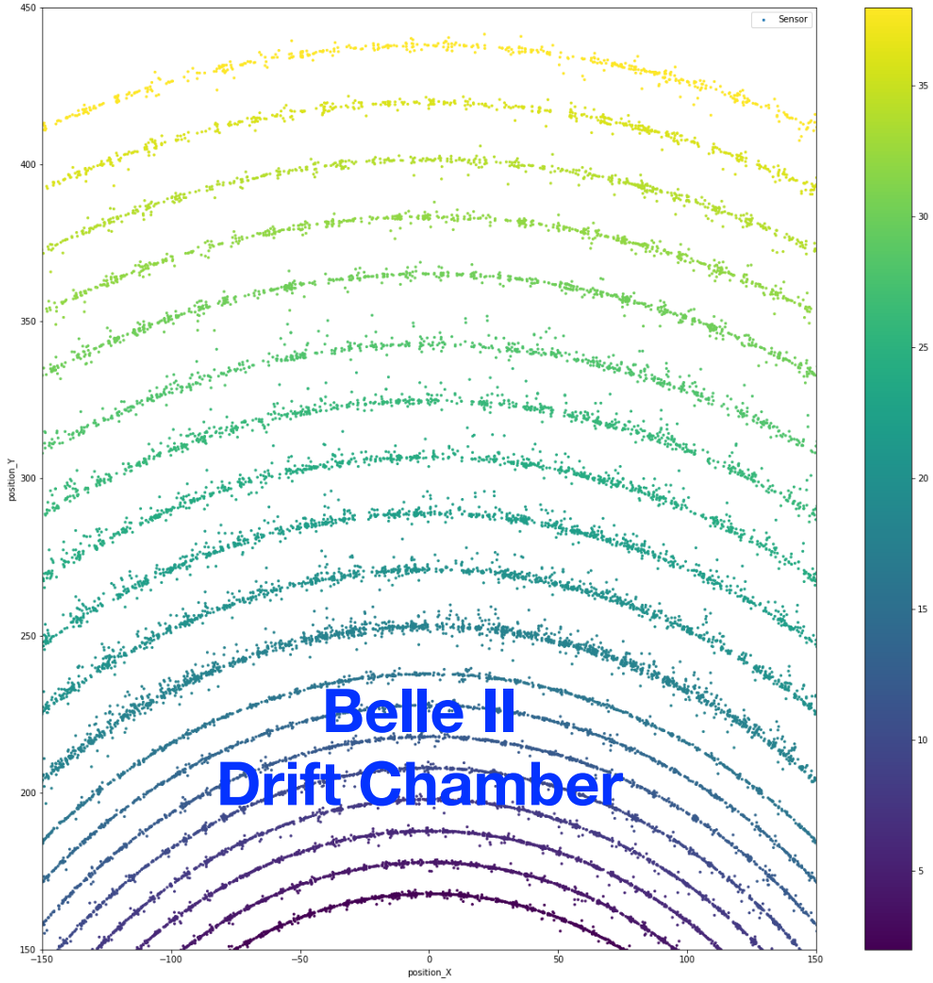
Project Participants: Timon, Simone, ...

- Full list available here:

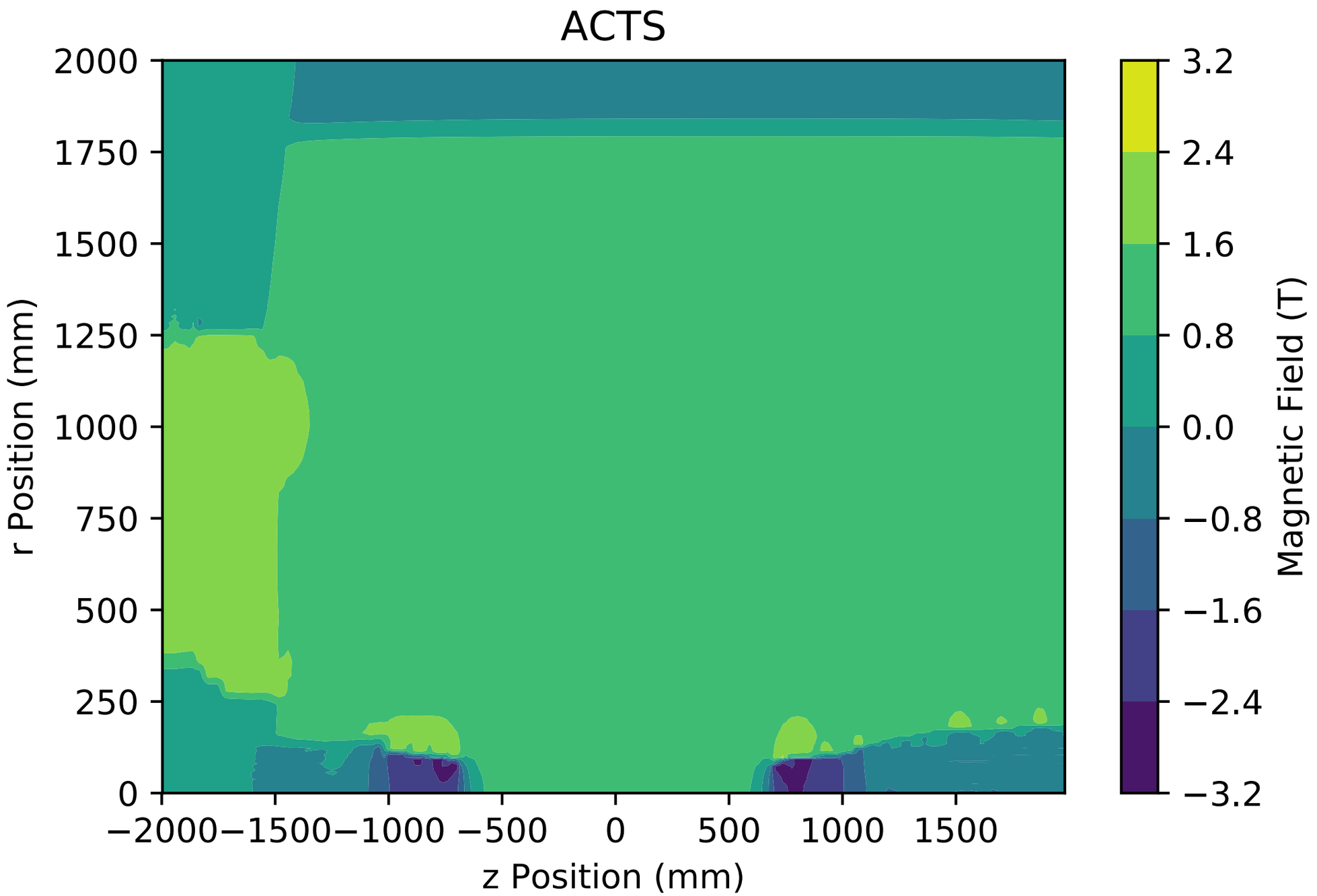
https://docs.google.com/presentation/d/1agWKZN0SiIwxptRfx6kIwx9GimhbvHdNTwCk2Afef9Q/edit#slide=id.p

First results: Belle II Geometry in ACTS

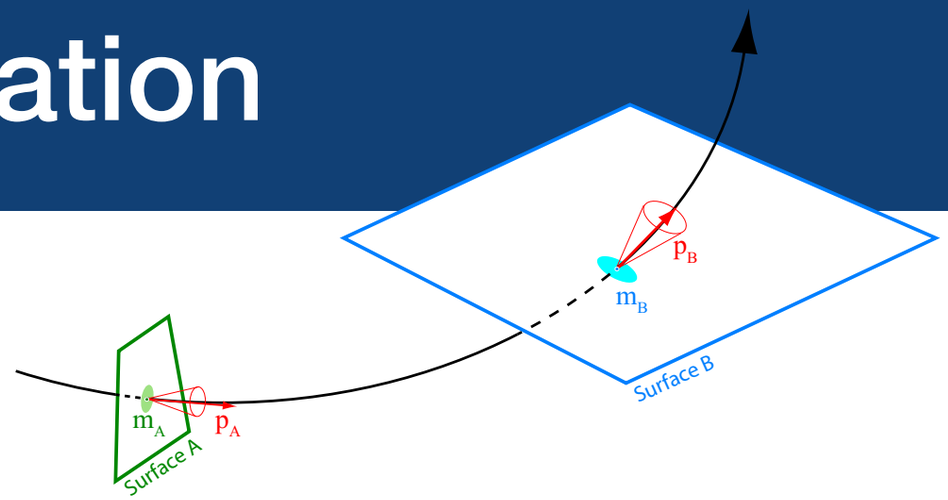




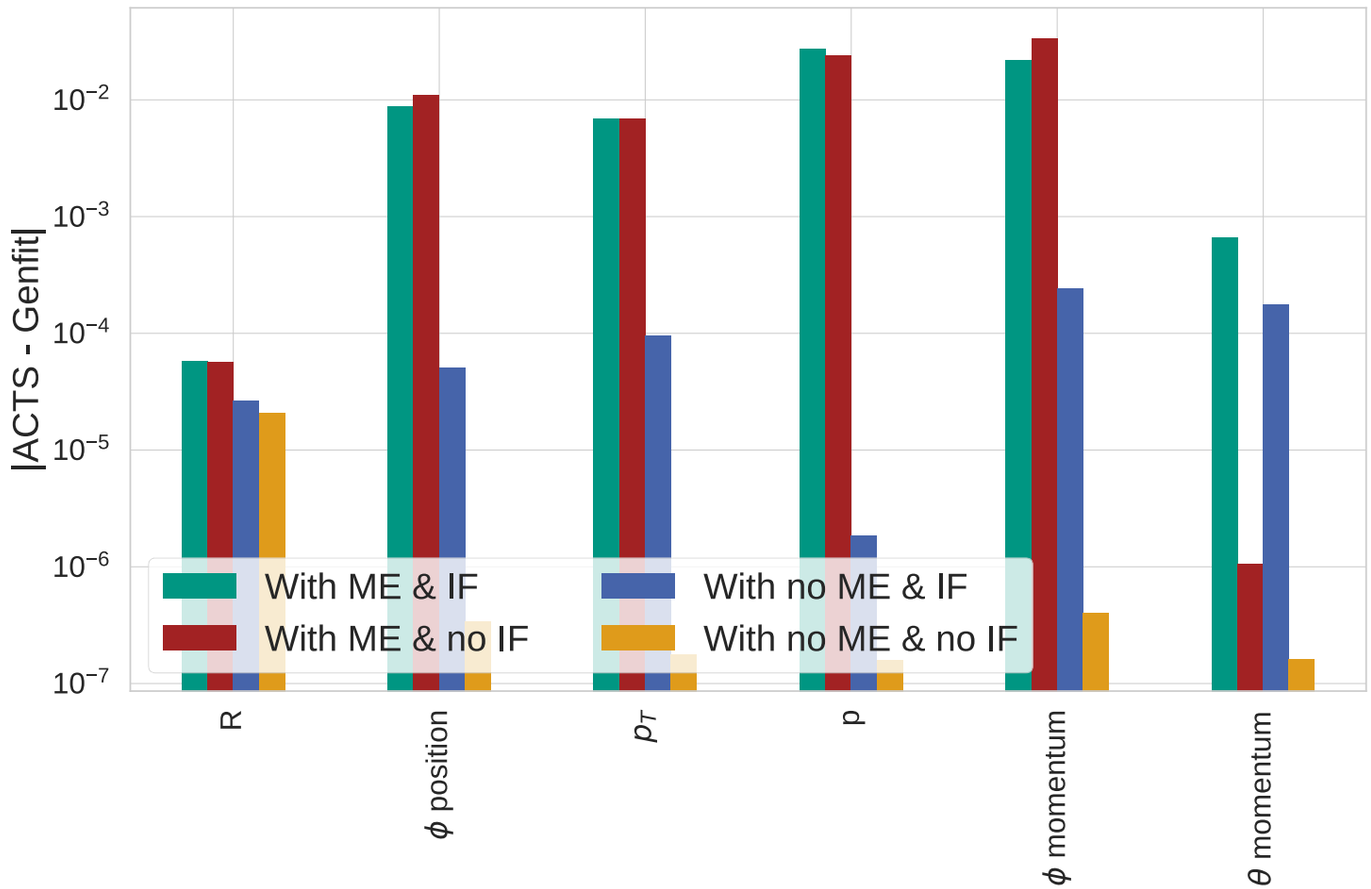
First results: Belle II Magnetic field



First results: Track extrapolation



Belle II algorithm versus ACTS



ME = Magnetic effects (turned on or off), IF = interpolated field of Belle II (instead of constant 1.5 T)

Conclusion

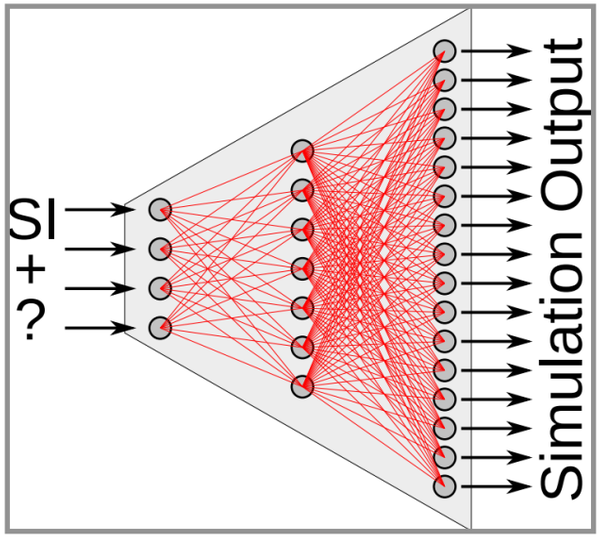
- There are not that many conceptual show-stoppers for just ”plugging the ACTS extrapolation into Belle II instead of genfit”:
  - No DAF (should be solvable easily)
  - No slanted parts (but not a conceptional problem with it)
  - Their Kalman is working a bit differently from ours, but should be no problem
  - Their CDC hit handling is different (maybe this will make a difference, maybe not)
- However, if we want to replace genfit with ACTS, there is a lot more to do:
  - The EDM is different
  - The measurement model is different
  - No CKF, no T_0
  - How about extrapolations in ECL, (B/E)KLM etc.?

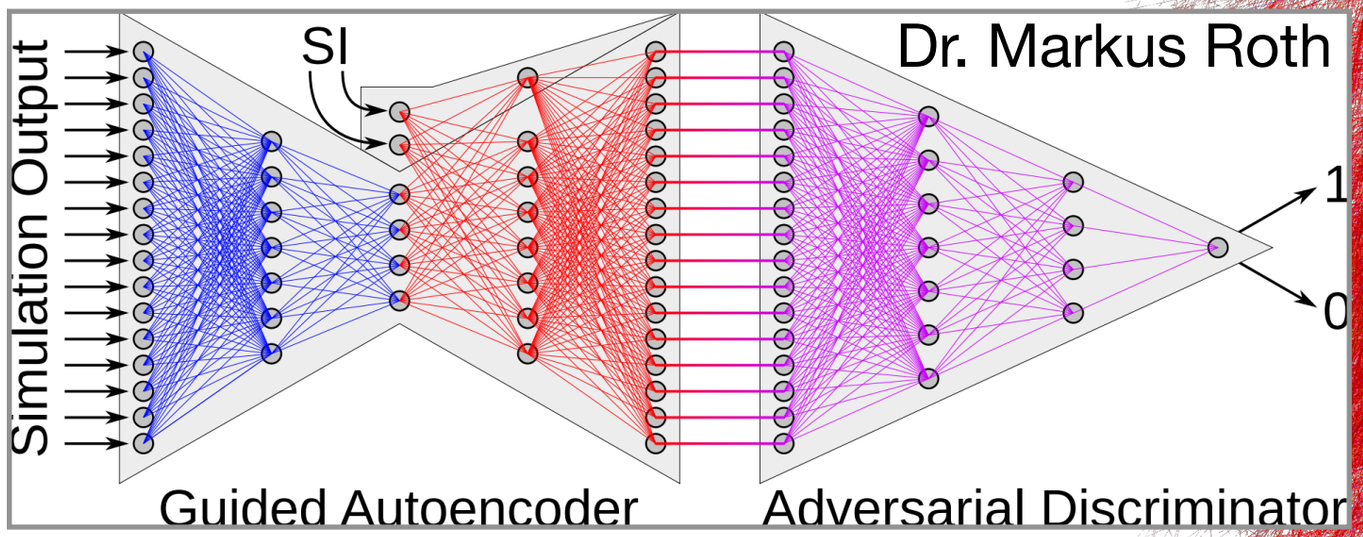
Dr. Nils Braun

- Could carry out first preliminary studies;
- KIT group could connect with the ACTS developers
  - Involved people at KIT: me, **Dr. Nils Braun**, Patrick Ecker, Lu Cao, Pablo Goldenzweig, **Michael Eliachevitch**
- Plan to organize **follow up workshop** in **August** or **September** in **Germany** with a similar style of agenda
  - Tutorials, some overview talks but ample time to work on dedicated projects with ACTS experts in the room to help.

AP C3: KIT

- Simulation of extensive air showers or hadronic / electromagnetic showers from first principles are time intensive tasks
- Can we delegate the entire simulation (or parts of it) to a neural network?





Key challenge: sparse input features, e.g. particle type, energy, mass, etc. —> misses randomness of MC simulation

Reproducing T. Comput Softw Big Sci (2019) 3: 4

Martin Erdmann, Jonas Glombitza, Thorben Quast